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| 10/027,251 | 12/21/2001 | Wen Lu | S-2000.1223 | 9015 |

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EXAMINER

PARSONS, THOMAS H

| ART UNIT | PAPER NUMBER |
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1745

DATE MAILED: 10/22/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/027,251

Applicant(s)

LU ET AL.

Examiner

Thomas H Parsons

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 December 2001.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-47 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3, 6-15, 18, 21, 22, 25-27, 30-39, 42, 45 and 46 is/are rejected.
- 7) ☒ Claim(s) 4, 5, 16, 17, 19, 20, 23, 24, 28, 29, 40, 41, 43, 44, 47 and 48 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 21 December 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other:

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities:

Page 10, line 18, suggest changing "or a or a substituent" to --or a substituent--;

Page 15, line 14, "...the \end of a ..." appears awkwardly worded;

Page 28, line 25, where is Figure 14.

Appropriate correction is required.

Claim Objections

2. Claims 3 and 33 are objected to because of the following informalities:

Claim 3, line 3: suggest changing "second electrode" to --counter electrode--; and,

Claim 33, line 1, suggest changing "claim 8" to --claim 25--.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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4. Claims 1-3, 8-15, 18, 21-22, 25-27, 32-39, 42, 45-46 are rejected under 35 U.S.C. 103(a) as being unpatentable over McEwen et al. (5,965,054), and further in view of Kobayashi et al. (4,740,436).

Claim 1: McEwen et al. disclose a method for inducing a response in a long-lived electrochemical device which comprises the steps of: contacting a working electrode and a counter electrode with an ionic liquid having an anion and a cation; and applying a voltage between the working electrode and the counter electrode, whereby the response is induced in the long-lived electrochemical device (col. 1: 60-col. 3: 20; and col. 6: 7-16).

McEwen et al. do not disclose a conjugated polymer working electrode.

Kobayashi et al. disclose a conjugated positive electrode and a negative electrode composed of an alkali metal, an alkali metal alloy or an electroconductive polymer (a conjugated polymer).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have substituted the electrodes of McEwen et al. for the electrodes of Kobayashi et al. because Kobayashi et al. on col. 1: 65-col. 2: 2 and col. 10: 9-25 disclose electrodes that would have provided a high energy density, good reversibility between charging and discharging, a very low self discharging ratio thereby improving the overall performance of batteries.

Claim 2: Because the McEwen et al. combination discloses the same ionic liquid and conjugated polymer as instantly disclosed, the claimed ionic liquid would obviously be stable in the presence of water, and the claimed conjugated polymer would obvious be stable in the presence of the ionic liquid.

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Claim 3: Because the McEwen et al. combination discloses the same ionic liquid as instantly disclosed, the claimed ionic liquid would obviously be stable for voltages applied between the conjugated polymer electrode and the second electrode in the range from -3 V to +3 V relative to a standard hydrogen electrode.

Claims 8 and 9: McEwen et al. disclose on col. 3: 4-6 that the anion comprises a small, weakly coordinating anion wherein the anion is selected from the group consisting of BF.sub.4.sup.-; and PF.sub.6.sup.-.

Claim 10: McEwen et al. disclose on col. 2: 17-65 that the cation is selected from the group consisting of pyridinium ions, pyridazinium ions, pyrimidinium ions, pyrazinium ions, imidazolium ions, pyrazolium ions, thiazolium ions, oxazolium ions, and triazolium ions.

Claim 11: The rejection is as set forth above in claim 1 wherein Kobayashi et al. further disclose that the conjugated polymer is selected from the group consisting of polyphenylene, polypyrrole, polyaniline, polythiophene, polyacetylene, and derivatives thereof (abs., and col. 7: 21-25).

Claim 12: The rejection is as set forth above in claim 1 wherein Kobayashi et al. further disclose that the conjugated polymer comprises a copolymer selected from the group consisting of phenylene, pyrrole, aniline, thiophene, acetylene, and derivatives thereof (col. 7: 21-25).

Claim 13: The rejection is as set forth above in claim 1 wherein Kobayashi et al. further disclose that the conjugated polymer comprises an oligomer selected from the group consisting of phenylene, pyrrole, aniline, thiophene, acetylene, and derivatives thereof (col. 7: 21-25).

Claims 14 and 15: McEwen et al. disclose on col. 3: 5-8 that the ionic liquid further comprises an organic cosolvent, and wherein the organic cosolvent is selected from the group consisting of cyclic ethers, esters, carbonates, lactones, nitrites, amides, sulfones, and sulfolanes.

Claim 18: The rejection is as set forth above wherein the McEwen et al. further disclose that the electrochemical device comprises a capacitor (col. 3: 18-26), the response comprises storing a charge on the capacitor, and Kobayashi et al. disclose on col. 7: 21-25 that the counter electrode comprises a conjugated polymer electrode (electroconductive polymer).

Claims 21 and 22: The rejection is as set forth above in claim 1 wherein further McEwen et al. disclose that the device comprises a rechargeable battery (secondary battery), the response comprises storing and deriving electrical energy from the battery, and Kobayashi et al. disclose on col. 7: 11-21 that the working electrode comprises a metal electrode (Li) having a redox potential lower than the redox potential for the conjugated polymer electrode, and wherein said metal electrode comprises lithium.

Claim 25: McEwen et al. disclose a long-lived electrochemical device comprising a working electrode; a counter electrode; an ionic liquid having an anion and a cation in contact with both the working electrode and the counter electrode; and an electronic power supply for applying a voltage between the working electrode and the counter electrode, whereby the response is induced in the long-lived electrochemical device (col. 1: 60-col. 3: 20; and col. 6: 7-16).

McEwen et al. do not disclose a conjugated polymer working electrode.

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Kobayashi et al. disclose a conjugated positive electrode and a negative electrode composed of an alkali metal, an alkali metal alloy or an electroconductive polymer (a conjugated polymer).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have substituted the electrodes of McEwen et al. for the electrodes of Kobayashi et al. because Kobayashi et al. on col. 1: 65-col. 2: 2 and col. 10: 9-25 disclose electrodes that would have provided a high energy density, good reversibility between charging and discharging, a very low self discharging ratio thereby improving the overall performance of batteries.

Claim 26: The rejection of claim 26 is as set forth above in claim 2.

Claim 27: The rejection is as set forth above in claim 3.

Claim 32: The rejection is as set forth above in claim 8.

Claim 33: The rejection is as set forth above in claim 9.

Claim 34: The rejection is as set forth above in claim 10.

Claim 35: The rejection is as set forth above in claim 11.

Claim 36: The rejection is as set forth above in claim 12.

Claim 37: The rejection is as set forth above in claim 13.

Claim 38: The rejection is as set forth above in claim 14.

Claim 39: The rejection is as set forth above in claim 15.

Claim 42: The rejection is as set forth above in claim 18.

Claims 45 and 46: The rejection is as set forth above in claims 21 and 22.

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5. Claims 6, 7, 30 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over McEwen et al., and further in view of Kobayashi et al. as applied to claims 1 and 25 above, and further in view of Koch et al.

McEwen et al. and Kobayashi et al. are as applied, argued, and disclosed above and incorporated herein.

The McEwen et al. combination does not disclose that the anion comprises a weakly coordinating anion, and wherein the anion is selected from the group consisting of F.sup.-; Br.sup.-; I.sup.-; NO.sub.3.sup.-; N(CN).sub.2.sup.-; RSO.sub.3.sup.- where R is an alkyl group, substituted alkyl group, or phenyl group; (CF.sub.3).sub.2PF.sub.4.sup.-, (CF.sub.3).sub.3PF.sub.3.sup.-, (CF.sub.3).sub.4PF.sub.2.sup.-, (CF.sub.3).sub.5PF.sup.-, (CF.sub.3).sub.6P.sup.-, (CF.sub.2SO.sub.3.sup.-).sub.2, (CF.sub.2CF.sub.2SO.sub.3.sup.-).sub.2, (CF.sub.3SO.sub.2).sub.2N.sup.-, CF.sub.3CF.sub.2(CF.sub.3).sub.2CO.sup.-, (CF.sub.3SO.sub.2).sub.2CH.sup.-, (SF.sub.5).sub.3C.sup.-, (CF.sub.3SO.sub.2).sub.3C.sup.-, [O(CF.sub.3).sub.2C.sub.2(CF.sub.3).sub.-2O].sub.2PO.sup.-, and CF.sub.3(CF.sub.2).sub.7SO.sub.3.sup.-.

Koch et al. discloses on col. 3: 50-54 that the anion comprises a weakly coordinating anion, and wherein the anion is selected from the group consisting of (CF.sub.3).sub.2PF.sub.4.sup.-, (CF.sub.3).sub.3PF.sub.3.sup.-, (CF.sub.3).sub.4PF.sub.2.sup.-, (CF.sub.3).sub.5PF.sup.-, (CF.sub.3).sub.6P.sup.-, (CF.sub.2SO.sub.3.sup.-).sub.2, CF.sub.3CF.sub.2(CF.sub.3).sub.2CO.sup.-, (CF.sub.3SO.sub.2).sub.2CH.sup.-, (SF.sub.5).sub.3C.sup.-, and [O(CF.sub.3).sub.2C.sub.2(CF.sub.3).sub.-2O].sub.2PO.sup.-.

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Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the ionic liquid of the McEwen et al. combination by incorporating the anions of Koch et al. because Koch et al. on col. 2:5-8 teach anions that would have provided an ionic liquid with high thermochemical and electrochemical stability thereby improving the overall lifetime and performance of the device.

Allowable Subject Matter

6. Claims 4, 5, 16, 17, 19, 20, 23, 24, 28, 29, 40, 41, 43, 44, 47 and 48 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Reasons for Indicating Allowable Subject Matter

7. The following is a statement of reasons for the indication of allowable subject matter:

A search of the prior art of record failed to reveal or explicitly teach alone or in combination what is instantly claimed: in particular,

A method of inducing a response in a long-lived electrochemical device wherein the ionic liquid comprises a mixture of ionic liquids (claim 4);
the ionic liquid comprises at least one ionic solid dissolved in a nonaqueous solvent where the resulting solution being mixed with another ionic liquid (claim 5);
the electrochemical device comprises an actuator, the response comprises a change in stress and strain of the actuator, and the counter electrode comprises a metal electrode (claim 16), and the counter electrode comprises a conjugated polymer electrode (claim 17);

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the conjugated polymer electrodes comprise porous conjugated polymer films having a conducting metal coating on the side thereof facing away from the ionic liquid (claim 19);

the conjugated polymer electrodes comprise conjugated polymer films electrochemically synthesized using the ionic liquid and having a conducting metal coating on the side thereof facing away from the ionic liquid (claim 20).

the conjugated polymer electrode comprises a porous conjugated polymer film having a conducting metal coating on the side thereof facing away from the ionic liquid (claim 23); and,

the conjugated polymer electrode comprises a porous conjugated polymer film electrochemically synthesized using the ionic liquid and having a conducting metal coating on the side thereof facing away from the ionic liquid (claim 24).

For this reason, claims 4-5, claim 16 and claim 17 which is dependent thereon, claims 19-21, and 23-24 are patentably distinct from the prior art of record.

A long-lived electrochemical device wherein

the ionic liquid comprises a mixture of ionic liquids (claim 28);

the ionic liquid comprises at least one ionic solid dissolved in a nonaqueous solvent where the resulting solution being mixed with another ionic liquid (claim 29);

the electrochemical device comprises an actuator, the response comprises a change in stress and strain of the actuator, and the counter electrode comprises a metal electrode (claim 40), and the counter electrode comprises a conjugated polymer electrode (claim 41);

the conjugated polymer electrodes comprise porous conjugated polymer films having a conducting metal coating on the side thereof facing away from the ionic liquid (claim 43);

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the conjugated polymer electrodes comprise conjugated polymer films electrochemically synthesized using the ionic liquid and having a conducting metal coating on the side thereof facing away from the ionic liquid (claim 44).

the conjugated polymer electrode comprises a porous conjugated polymer film having a conducting metal coating on the side thereof facing away from the ionic liquid (claim 47); and,

the conjugated polymer electrode comprises a porous conjugated polymer film electrochemically synthesized using the ionic liquid and having a conducting metal coating on the side thereof facing away from the ionic liquid (claim 48).

For this reason, claims 28-29, claim 40 and claim 41 which is dependent thereon, claims 43-44, and 47-48 are patentably distinct from the prior art of record.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thomas H Parsons whose telephone number is (703) 306-9072. The examiner can normally be reached on M-F (7:00-4:30) First Friday Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Pat Ryan can be reached on (703) 308-2383. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Thomas H Parsons
Examiner
Art Unit 1745

Patrick Ryan
Supervisor, Patent Examiner
Techr.
